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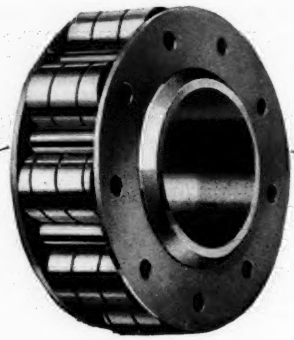

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Vol. 3 AUGUST, 1922 No. 8

Important Factors in Silage Cutter Design

By Arnold P. Yerkes

Member A. S. A. E. Editor, "Tractor Farming," International Harvester Company

THE prevalence of empirical methods in the designing and development of farm machinery has frequently been commented upon, and the desirability of ascertaining some fundamental facts to assist in the improvement of our agricultural equipment is well known.

Silo fillers are a good illustration of how machines can be designed and used for years with a fair degree of satisfaction without any definite knowledge of the relative importance of the various factors involved in doing the work. Perhaps it may seem that the present equipment is sufficiently satisfactory to make any further study of the problem of filling silos altogether unnecessary and unprofitable, but is it? Are we not putting ourselves in a position very similar to the man who takes an elephant gun and goes out shooting squirrels? Would not some reliable data on the subject enable us to design silage cutters which would fill the average silo with a much lower consumption of power?

On the face of it, it would appear that the majority of silage cutters on the market have been designed to deliver cut fodder or other material to the top of the tallest silos in use, and when these cutters are used on the shorter silos there is an enormous waste of power. Might it not be better to have most of our silage cutters designed to fill silos of average height, and where unusually high silos are to be filled furnish cutters of greater elevating capacity? Or would the saving of power in such case be too little to warrant this procedure? Or could the power which is now wasted in elevating the cut material at high velocity to a low height be more efficiently utilized in feeding and cutting more fodder per hour?

How much of the power consumed by a silage cutter is utilized in cutting the material? How much is absorbed by direct impact of the blower blades with the fodder? How much is consumed in blowing air through the delivery pipe? The answers to these questions are not to be found in our agricultural engineering literature today, but they certainly should be found there within the next year or two.

There are also a lot of other pertinent questions concerning silo fillers for which no answers can be found in our current literature. For example, what velocity of air is required in the delivery pipe to deliver different quantities of fodder to different heights? What should be the initial velocity of the cut material from contact with the blower blades? What is the relation of the velocity of the fodder to the velocity of the air? Which is the most important at different heights? What should be the shape and position of the blower blades to give the greatest velocity to the air at different speeds of the blower? Will the same shape give the greatest initial velocity to the cut fodder?

It is interesting to note that different makes of silage cutters are today equipped with different shaped blower blades. Some are perfectly flat, some concave, and some convex. The position of the blades also varies considerably. Why?

SHOULD WE LET WELL ENOUGH ALONE?

There is no doubt that present silage cutters cut the silage and put it into the silo with entire satisfaction so far as results are concerned. It is far from certain that there is not a vast waste of power in doing it. Now that tractors of small and medium size are used extensively for driving silage cutters it is doubly important that cutters shall be efficient as well as effective, since the capacity often depends on the power available

Do different rotating speeds affect the efficiency of the different shaped blades? Or would the efficiency of some of our present machines be increased by different shaped blades differently placed?

What is the relation between the volume of air passing through the delivery pipe and the quantity of material which can be safely carried? How does this relation change with different diameters of pipe? How does the length of pipe affect the quantity of air passing through? How does it affect the power requirements at various speeds?

At first thought it might appear that these questions are of minor importance. It might be argued that our present machines are doing the work and data along the lines indicated would be of little or no practical value. But is such the case? Let's see!

Every once in a while it occurs to a farmer that it is a waste of power to lift all his fodder to the top of his silo simply to have the greater part of it fall back several feet. A national farm paper recently published an item telling how a farmer has saved considerable time and fuel by filling his 48-foot silo three-quarters full through a hole at the height of 36 feet, and then filling the last quarter by blowing over the top in the usual manner.

Can the manufacturer or his experts tell a farmer whether such savings can be made, under what conditions, and how? Many men with long experience with silage cutters claim that less power will be required to operate a cutter with a short delivery pipe than with a long one, even at the same speed of the blower. This is not true of other blowers, and there is every reason to believe it is not true of silage cutters. The power required to operate other blowers varies with the amount of air handled, and as the delivery pipe is shortened the resistence is decreased, the amount of air handled increases, and the power also increases. This is doubtless true of silage cutters, and we should be prepared to advise farmers intelligently on such points—such information is intensely practical.

Fortunately, much of the needed data can be obtained without any serious difficulty or elaborate equipment. Definite information on many of the points mentioned can be gathered in the engineering laboratories of our agricultural colleges. It is to be hoped that several members of the A. S. A. E. will at once take steps to carry on at least some of the necessary tests and experiments to acquire the desired information. The season of the year is now at hand when this can be done most conveniently, and if a number of such tests are made the results can be checked against each other and greater accuracy obtained.

Possibilities in Agricultural Engineering*

RURAL engineering has come to mean a fairly definite thing. One bureau of the government at one time had the term in its name, and although the highway boom has now severed the titular tie, the work still goes on. Trade associations, too, dealing with engineering materials, have long recognized the market for their products on the farm and have devoted much of their professional literature thereto. There is, indeed, a society of agricultural engineers, with a publication and a fair sized membership list. When all this is said, however, it remains that here is an attractive field that has not been properly tilled; there ought to be in our rural district openings for farm engineering practice which engineers, especially young engineers with the proper training and inclination, have been neglecting.

Farming and farmers need the engineer. No great amount of argument is required to prove that. From the problems of drainage and irrigation down to those of building design, house and barn sanitation, and machinery layout and selection, the overhead expenditures of the farm are all based on considerations essentially engineering in character. The farmer is the largest producer in the United States, yet even the casual observer in rural districts sees many examples of waste and loss resulting from the failure to apply the engineer's point of view in solving certain problems of farm operation and production. One might go even further and say that in large-scale farming under conditions common to the West the successful farmers are those who by natural bent or training use the engineer's method of approach in solving certain of their problems.

The difficulty is in persuading the farmer that he does need the engineer. He is, by hereditary usage and by environment, the most self-sufficient of men. Advice is the last thing he formerly paid for, especially if that advice was from what he considers a theoretical or non-practical source. More and more, though, the farmer is coming to look to outside sources of information. He is a great reader of farm papers. He consults machinery salesmen for type and size of equipment. He studies the government and trade-association bulletins. For such men the step to paid engineering service should be shorter than it would have been in the old days when the farm was isolated and the farmer too prone to depend on his own personal experience.

Here may be the opportunity for the engineer who is willing to study the field and accommodate himself to its peculiarities. A farm upbringing is almost a necessity; a wide acquaintance in and of the neighborhood is a requirement; a high and mighty detached air cannot succeed. The farm engineer must get down with his clients and work out their problems to the last detail, and a proper neglect of unnecessary theory should breed a respect that display of book learning or fancy practice would soon destroy. Land surveying might for a while at least be the backbone of such a practice and with it might come some business as township advisor on road, bridge and similar problems, for work with and for the farmer would develop slowly.

*An editorial appearing in the May 11, 1922, issue of "Engineering News-Record."

Mixing Cement with Soil in Road Building

MIXING cement with certain type of soil to alter the characteristics of the soils and make them more suitable for road surfacing and subgrades is an experiment recently conducted by the bureau of public roads, of the United States Department of Agriculture, which is now proving its value in actual use. The treatment was first suggested and tried out at the Arlington experimental station of the bureau. Results warranted a field test, and it was arranged with the California state highway department to try it on the adobe soil there.

A part of a federal-aid project in Solano County was selected for the test. The dry soil was well broken up and harrowed to a depth varying from 6 to 12 inches and mixed with cement in the proportions of 1 part cement to 10 parts soil and 1 part cement to 20 parts soil. It was intended to water and roll the surface, but rain prevented. One section was allowed to remain untreated for purposes of comparison.

A recent inspection showed that the untreated section was badly broken up, due to the usual shrinkage cracks characteristic of adobe soils. The treated sections were in good condition and showed no shrinkage cracks. The treatment is not intended to make a hard surface like concrete, but to alter the properties of the soil so that it will be stable and lessen the effects of moisture.

Standardized Design Can Reduce Loss Between Tractor and Field Machines

By Walter B. Jones
Assoc. A.S.A.E. Associate Editor, "Power Farming" and "Power Farming Dealer"

A CONSIDERATION of tractor ratings and tractor performance justifies the general statement that under moderately unfavorable conditions only about one-half of the motor power of a tractor can be delivered at the drawbar. For the purposes of the present discussion it is unnecessary to analyze this fifty per cent power loss quantitatively into its components of mechanical friction, traction slippage, and rolling resistance.

In the absence of definite data it seems reasonable to assume that there is a similar loss of approximately fifty per cent when drawbar power is picked up from the ground by a bullwheel, transmitted through chains and gears and employed to drive the working parts of a machine. This is equivalent to saying that for each horsepower needed to operate a given machine, such as a grain binder, four horsepower must be generated by the tractor engine.

The glaring inefficiency of such practice needs no comment. Perhaps more important is the fact that it frequently is ineffective. By this I mean that there are frequently encountered farm conditions where it becomes impracticable to transmit power from engine to driven mechanism by way of drivewheel, ground and bullwheel because of the excessive or total slippage at one or both of these points.

The tractor was developed in the first place as a plowing engine, and developed from the steam threshing engine. Consequently, it was built to deliver power at two points, namely, the belt pulley and the drawbar.

Then came the application of tractor power to field operations other than plowing, but it is with harvesting operations that this discussion is concerned mainly. The more important harvesting machines employ for the most part rotary motion at speeds high in comparison to the rate of rotation of the ground wheels. Having been developed for use in connection with animal power these rapidly rotating parts are driven through the medium of more or less expensive and rather inefficient trains of gears or chains, particularly when considered in connection with the inevitable losses arising from taking power off the ground with a bullwheel. So far as is known to me there is but one exception to the rule that in the driving of harvesting machinery the power of a high speed engine is passed through a transmission system with a loss of something like fifteen per cent, laid down on the ground with a widely varying loss which may be considered roughly as thirty per cent, then picked up by a bullwheel of similar inefficiency and speeded up with a power loss presumably similar to that involved in the gearing down process.

From the nature of the engineering principles involved it is inevitable that means shall be developed for transmitting power by rotary motion directly from the tractor to the working parts of the machine being driven, utilizing the drawbar power of the tractor, with its accompanying losses, only for pulling the machine.

While the direct application of power is desirable for all drawbar machines employing rotary motion, it is most important for those involving considerable amounts of power, and with which traction difficulties are most often encountered in practice. The outstanding examples which occur to me are the manure spreader, mower, grain binder, corn binder, corn picker, and, perhaps in a future development, combination harvester-threshers of small and medium size.

In order for this obviously inevitable step to be taken with the greatest possible promptness and economy, it will be necessary to employ from the very outset the principle of standardization, or as it has become the fashion to call it, simplification. It must be possible for any driven machine of any manufacturer to be attached to and driven by any tractor model made by any manufacturer with the same ease and certainty that anyone's freight car is coupled behind anyone's locomotive.

Of the features of design to be standardized if possible at the very beginning of this development, perhaps the most important is the design of coupling whereby connection is made between the machine shaft and the tractor shaft. Probably the design of coupling will be tied up closely with the universal joint or its equivalent which is used for taking care of varying relative positions of tractor and machine. Because of the wide range in tractor size and power requirements in various machines it may be that several sizes of couplings will be found desirable. If this is done it would seem to me that the couplings should be so designed that by the use of adapters the gap between sizes might be bridged, much as small taper shank drills are used in a large drill press by using suitable bushings. Presumably the same principle might be followed, namely, that of permitting the handling of smaller machines and lighter loads than that for which the tractor is designed, but not permitting a large machine to be hitched to a small tractor.

There are also several points to be established in connection with the speed of the driving shaft. Should this speed be the same for all horsepowers, or should it be low for the smaller machines and higher for the larger sizes? As a suggestion for an important point to be considered, unless a uniform speed over the entire range of sizes was adopted the advantage of adapters would be largely if not wholly nullified. The question may properly come up as to whether the standard speed should be fixed or variable, or, what amounts to the same thing, several standard speeds for each size. The third important point in connection with speed is whether it should be considered in terms of revolutions per minute or in revolutions per foot of tractor travel.

That the direction of rotation should be standardized is almost too obvious to mention. Another point which should be standardized in advance is the location of the clutch whereby the driven machine is started and stopped. From the economic viewpoint it would appear better to put this device on the tractor, thereby avoiding the cost of providing one for each of the driven machines. Presumably a friction type of clutch should be employed. Certainly it seems obvious that some means be provided whereby the mechanism of the driven machine might be brought up to speed before it begins to travel forward and handle material.

The position of the transmission shaft on both tractor and driven machines calls for some attention and perhaps will be one of the hardest points to standardize. At first thought the obvious location would seem to be on the center line of both machines directly above the point of hitch and as close to it as may be practicable, in order to reduce to a minimum the amount of telescoping action necessary in the shaft.

Flood Control in Miami Valley*

By O. N. Floyd

Division Engineer, Miami Conservancy District

WE HAD a flood in the Miami Valley which you have heard more or less about, the flood of March, 1913, in southern Ohio. Something like five hundred lives were lost at that time. No one ever tabulated exactly the property damage but it was variously estimated at from one hundred and fifty to two hundred and fifty million dollars. The cities of Piqua, Troy, Dayton, Miamisburg, Franklin, Middletown, and Hamilton were all flooded and more or less torn up. In Dayton alone there were seven square miles flooded in the business and manufacturing districts. This flood ran anywhere from a foot up to twenty-five feet deep. In Hamilton where the velocities were much higher on account of the greater volume and a little more slope to the valley it almost ruined the town.

Immediately after the flood naturally the people of the valley began to discuss what they could do, what they should do. The Morgan Engineering Company was asked to handle the situation, and I was sent to the Miami Valley to make surveys and to collect such other data as might be helpful in formulating some sort of plan for flood protection.

It took us about ten months to make surveys and collect sufficient data to begin to have much of an idea ourselves as to what could be done. We had no more idea of the final plan for the first few months than anyone else had; it was forced on us by the process of elimination. We investigated many plans which were too expensive or otherwise impracticable.

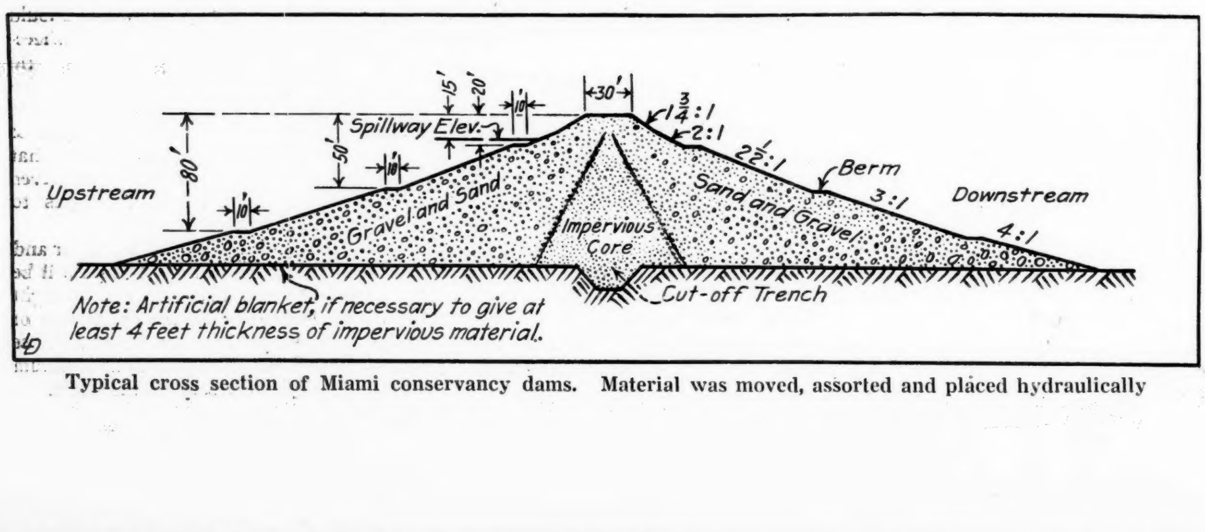
We found it much cheaper, after carefully analyzing all our data, to plan a system of retarding basins to benefit all the cities and protect the whole valley rather than protect Dayton alone by channel improvement. We then set out to find some way whereby a strip of territory over 120 miles long, involving about seven counties and a number of towns and villages, could cooperate. We found there was no law on the statute books under which we might work. The governor of Ohio at that time lived in Dayton and knew what the flood had done, and he was very anxious to help out. He called a special session of the Legislature and what we called the Ohio Conservancy Law was passed.

The work up to this time had been carried on by a flood prevention committee, the same committee that was organized and employed Mr. Morgan in the beginning. They had no legal status, except they were incorporated, but they raised by private subscription in Dayton a fund for carrying this work forward, to which 23,000 people subscribed. The entire amount was a little more than two million dollars—that was by private subscription, understand—no law, assessment, or anything of the kind. Of course, that gave the flood prevention committee a good standing. They had no legal standing, but they had the money back of them to pay for surveys, lawyers' fees, and such other expenses incidental to the carrying forward of this work.

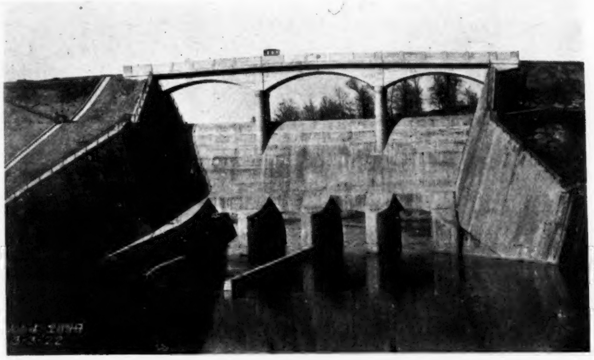
We worked under this committee until the law was enacted and the Miami Conservancy District organized. The organization of the District had to be approved by the court; the law provides that the district shall be under the supervision of the conservancy court. The conservancy court consists of one common pleas judge from each county affected by the District, in this case seven common pleas judges meet together in Dayton as a conservancy court. They have jurisdiction over all the work. The law provides that they shall appoint a board of directors of three men for a term of six years. This board of directors then operates the district in very much the same manner as the board of directors of a corporation operates. Col. E. A. Deeds was appointed on the board from Dayton, H. M. Allen, of Troy, from the northern part of the territory, and Gordon S. Rentschler, a prominent business man in Hamilton, from the southern part of the territory. Col. Deeds was elected chairman of the board and is still its chairman. The court also appoints a board of three appraisers which is independent of the directors.

The board of directors instructs the engineers to prepare an official plan, and they have to work out this plan, setting forth in more or less detail just what it is expected to do. When this plan has been approved by the board it is filed with the court for their approval. The court may approve the plan or they may return it for correction or amendment, but any property owner may object to the plan and be heard in court before the court's verdict is given. When the plan is finally approved the court instructs the appraisers to go out and appraise the damage and the benefit according to this plan. The appraisers report directly to the court and they have to appraise all property, whether benefited or damaged by the project, and their appraisal roll is submitted to the court, and, if approved, it is then open to public inspection, and every person has a right to come in during a period of thirty days and make complaint. There is something over sixty thousand different pieces of property affected, so you

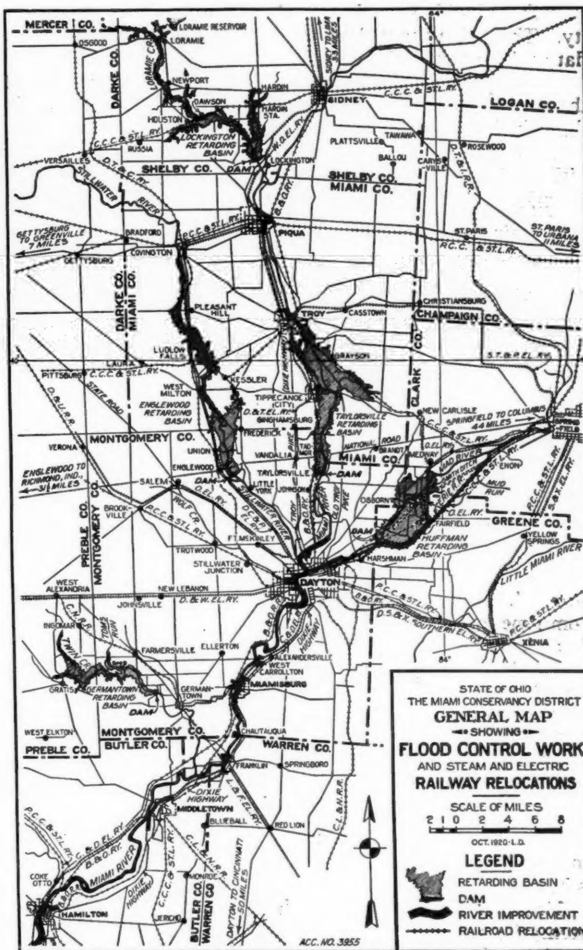
*From an address before the fifteenth annual meeting of the American Society of Agricultural Engineers, Chicago, December, 1921.



Typical cross section of Miami conservancy dams. Material was moved, assorted and placed hydraulically



Outlet, spillway and spillway bridge at Taylorsville, dam. Each of the conduits is 15 feet wide and 19 feet high. Crest of spillway is 58 feet above conduit floor and 19 feet below top of dam. A flood like that of 1913 would rise to within 3½ feet of spillway crest and drain out through conduits in seven days



Map of the Miami Conservancy district

can imagine the complaints we got, but not nearly as many as you might suppose, only a small percentage; however, it ran up to a few thousand.

This work took about two years, even after we got our district organized. The appraisers, of course, went to work as soon as the plan was approved and they employed many assistants, but they themselves had to pass final judgment on every piece of property in the District. The engineers furnished much of the data for them to work on, such as flood heights in the valley from the 1913 flood for property benefited and property damaged, made up a contour map showing the depth of flooding of all the different property, and where we could we gave some idea of the velocities and destructive effects of the currents. In the basis we had to show the depth and duration of flooding that would likely occur after the dams were in. This was largely the basis of the damage to property in the basin. Largely the appraisal of benefits is a matter of judgment, just as the assessor's work for taxing is a matter of judgment. But what they tried to find out was what this property was worth in its present condition and what it would be worth if it were fully protected. Before they could arrive at that, it was necessary to know how it was affected by the flood, and also how it would be affected by the official plan. If it were not affected at all they set it aside, and if it were only partially affected it came in for a slight benefit. Then the question they would ask themselves was, "How will it be affected after the official plan is put into operation? Will it be completely protected? Or will it be only partially protected?" Not all property was completely protected. That applies especially to farm lands. Practically all city property is completely protected, but the farm lands we could not protect fully at any reasonable cost.

In this district I think there are something like one hundred thousand acres of farm land, but it only pays about one per cent of the total cost.

The total cost of the project was thirty-five million dollars. The assessed benefits against the property is about two and a half times that amount. The farm lands are not completely protected from overflow, because the river channel itself carries such a small proportion of the flood flow, and that part of the valley subject to flooding is so narrow, the average width being about a mile, that the expense of further restricting the flood flow by retention basins so as to confine it to the river channel through the rural district would have been more than the value of such lands. The only way to have protected these lands completely would have been to supplement the retention basins by building levees. But the farm lands could not stand the cost.

On the other hand, the overflow on most farm lands does little harm. Most of the farmers do not object to their land being overflowed; they rather like it if the velocities are not destructive.

Now the ordinary floods and the floods such as will go through the dams will not rip the farm property up, make gulleys down through it, or deposit great beds of gravel in other places, as the 1913 flood did, because the volume is not great enough and the velocity is not high enough. So we have given the farm lands a degree of protection that is practically as much as they need, because it is expected that the lands down in the valley will overflow, and most of the farmers prefer that they overflow still.

Because the plan for the Miami Valley has proven a happy solution of the flood problem there and the only solution that was financially possible, many people in other localities have jumped to the conclusion that it would be the solution of their flood problem. We have had to say in the case of a number of the projects we have examined in a preliminary way that such a system was not applicable. Many people want to know why we cannot control the Ohio River in the same way, and some think the Mississippi River should be so controlled.

It happens that the drainage area above Dayton is spread out somewhat like a fan, the three rivers coming together there, and the topography makes it very convenient to get a basin on each river. On the larger watershed we put a basin on the main river and one on one of the main tributaries, making two in this same drainage area. The valley is flat

enough and wide enough so that we got good storage capacity. The fall in the valleys there runs from five feet down as flat as three feet to the mile.

One of the illustrations shows a typical cross section of the Miami Conservancy dams. We pumped the material in through dredge pipes and the gravel stays near where it is discharged from the pipe, while the mud flows some distance with the water. We keep the outside of the fill higher than the middle, and the water flows in and the mud, fine silt and sand retained in the water goes to the core pool and settles out. The water was then drawn off at the top, leaving a mud core in the middle and the gravel on the two slopes. An effort was made to keep the thickness through the mud core equal to the distance from the top down. If the dam were 100 feet high we would want the core to be about 100 feet wide at the bottom. When within twenty-five feet of the top the core should be about twenty-five feet wide. It is not necessary to have a core that wide, in our material at least, because a thin layer is quite impervious, but for practical and mechanical reasons you cannot work too close. The line between the gravel and the core cannot be controlled absolutely. If allowance is not made for the irregular extension of the gravel into the core it may be the gravel from one side will meet the gravel from the other.

Practically all of the core material will pass a 200-mesh sieve. The Department of Agriculture analyzed it for us from time to time. They classified it as coarse sand, silt, and clay. Samples of it taken after it is dried out may be polished more or less like soapstone. Right on top it is rather polished but after it has been built up a few feet and some of the water squeezed out of it, it weighed about 125 pounds to the cubic foot, which is about the same weight as saturated gravel. If the core is too fine or light the gravel is likely to sluff in and press the core out.

DISCUSSION

MR. CROMLEY: I understand you are making use of the land in the reservoirs for agricultural purposes. Can you tell us how you are handling that?

MR. FLOYD: Back of the dams we have no gates, it is automatic, somewhat like a funnel. You know when you pour into a funnel real fast it will fill up, and if you quit pouring it will run empty. All the records for Dayton show (we have a government record there daily for about twenty-nine years) four floods in that time that would have caused any flooding at all from about April 15 to January 1. There is small chance for a flood that would flood the basins during the crop growing season. It will be safe to plant most any thing in these basins after about the middle of April, except possibly down near the dam, where an ordinary little flood might cause a rise of five feet and a little head on the conduits.

We planned to utilize the basins still as farm land. There was much opposition to this project, however. The farms in the basins had not been subject to serious flooding and we had to get land there for the benefit of the towns, which is a little bigger scheme in social cooperation than the average fellow is used to. Some of the people objected very strenuously, and a few politicians took advantage of their fears. We tried hard to get the farmers to understand that the best thing for them to do was to sell the District a flood easement on the land, the value of which the appraisers appraised at anywhere from five dollars up to fifty dollars an acre. We tried to get them to let us pay them the easement value and they keep their farms, with certain restrictions as to buildings. Many of the farmers did; some did not; and in that case we had to take their land outright. But most of that land now is being sold with flood easement retained, sometimes to the very farmers we bought it from. They have more confidence now in our scheme and there is considerable demand for this land.

As soon as the Conservancy District came into possession of this land one of the best farm managers in the country was put in charge of it. As a revenue producer, the farm department has made a good showing, although it is not the policy of the district to hold farm land, only until it can be sold advantageously. I see no reasons why there should be any restrictions on any kind of a crop in the basins, except upon winter wheat and alfalfa or something of that kind that has to go over through the winter and spring and this would apply only on very low ground.

In figuring the probability of these floods, we do not have records enough to predict with much accuracy how often the big floods will come, but they probably would not come oftener than once in a hundred years, and the floods that will fill the basin to about half full it seems may come about every forty to fifty years. A flood that will cover more than a third the area will likely come about once in twenty years. This latter size seems to come along quite regularly, judging from the history of the valley. We have no definite records back of 1892; the other is all history, but the history appears to be fairly reliable from about 1800 on.

MR. BISHOP: The consistency of the core wall I presume was more or less a viscous mass. I was wondering if the drainage took place through the coarser materials or whether holes were placed in the side walls and slopes of the dam to take care of the water in that center core wall. Was the water drawn off from the surface?

MR. FLOYD: Yes, drawn off from the surface. We had a regular spillway for that. We had a concrete well built in a recess in the wall and put concrete blocks up over that as we came up, and drew it off from the surface. But there was a lot of seepage through the coarser material. We had to watch out for that. We found we could not lay our pipe line as close to the edge of the slope as we got higher, as we did further down, because it was liable to get it saturated near the discharge and somebody would come along and step on it causing a small slip. A tremendous amount of water seeps out through the gravel, most of it from the pool, but that is largely the way, I think, that the outward part of the mud gets rid of its water and solidifies, although a large part of the water comes upward out of the mud strata through pressure. Sometimes we would be shut down for a few days and the water in the pool would become clear, and one could see the little streams of muddy water rising all through the thin mud on top, which indicated that the pressure from the top was causing the water to come up. We had some pressure cells gotten up by the Department of Agriculture which we used in the core. They seemed to work very well, although they are new and we do not know just exactly what they do indicate, but they seem to indicate that the core solidified rather fast as the dam came up, probably more from pressure than from anything else. At a certain depth it does not seem to matter much how fast the dam comes up, the core seems to get about so solid. The pressure cells were set some for horizontal pressure and some for vertical pressure.

MR. BISHOP: You figured on the lateral pressure against the gravel. The thickness of the section would be sufficient to take care of the lateral pressure from the viscous core, wouldn't it?

MR. FLOYD: Yes. That is one of the things that you cannot overlook. We had a very large factor of safety there. We figured that first and we found it gave a core too wide, more than was needed. The core is always a source of danger while the dam is under construction. If anything happens to the outside, for instance, if the pool water on top happens to break over the levee, it washes the gravel out, and if it is not closed at once it may wash out a place in a few minutes large enough to hide a residence. After it gets started it will make a messy job. Those are some of the ugly sides of the hydraulic fill, but they are likely to occur on any job.

EDITOR'S NOTE: The principal part of Mr. Floyd's talk was given with lantern slides and therefore had to be condensed considerably before publication. This accounts for the lack of order in places.

Relation of Barn Construction to Sanitation*

By C. S. Whitnah

Jun. A.S.A.E. Associate Research and Extension, King Ventilating Company

THERE are two distinct reasons why the plan and construction of the farm structures in which animals are housed are intimately related to the ventilation. One is that the ventilating system, if planned at the same time as the building, can be installed so that it will have maximum efficiency and convenience in handling the animals in the building; the second is that the loss of heat through the walls makes the stock room cool off and, if excessive, causes condensation.

There has been some confusion in the past among students of ventilation and the construction of farm buildings about the necessity of warmly insulated walls in order to obtain sanitary conditions in the stable room. This confusion has arisen, largely from the taking of the maintenance of a desirable temperature as the only basis for the need for a warmly insulated wall. It must be remembered that the condensation of moisture on the inside of the wall occurs only when the temperature of this inside surface is lower than the dewpoint of the air.

Aside from the question of the maintaining of a desirable temperature, it has been found necessary to insulate the walls of the room in order to keep them dry and free from frost.

Considered from the standpoint of the barn owner who is desirous of obtaining sanitary conditions in his barn, the installation of a ventilating system and the proper insulation of the walls are two separate improvements which he must make in order to make the conditions sanitary.

If the farmer is interested in keeping the walls, ceiling, and windows of his stable sanitary, that is, dry and free from mold, he must, in addition to installing a ventilating system, insulate the walls and openings. The temperature of the material at the inside of the wall should not be many degrees colder than the air of the barn itself. In order that the conditions may be entirely sanitary, he must also plan his barn so that when it is full of stock, there will be enough animal heat to heat the room properly.

These are primary essentials for the housing of farm animals. The influence of damp walls, frost-covered windows, and dripping ceilings is bad for the health of the animals. If the walls are wet they are bound to be dirty and unsightly and to foster the presence of disease germs and so act to destroy the building. It is true that there is some controversy in regard to the exact values to be applied in some cases, and yet the results that are being obtained by installing radiation in proportion to the amount of heat loss and ventilation, have worked out so successfully that there is no room for criticising this method. It is well known that this has been used in all types of heating and ventilating, except farm buildings.

The practice of heating buildings by artificial heat differs from the application of the estimation of heat loss from animal shelters, in that, in the first case the amount of radiation can be varied to suit the case and in the second case, the amount of heat is constant and the construction must be varied to suit the needs.

It is the use of this heat which must be varied, because the production of the heat of animals does not vary within wide ranges. While in the artificially heated building, the estimate of the heat loss is the basis for the installing of a heating plant, in the animal shelter the heat loss must be considered first in designing the barn so that there will be sufficient animal heat to keep the barn warm, and, second, in the actual construction of the walls so that they are within the limits required to retain the heat so that there will be a comfortable temperature.

Another fundamental difference between the application of the estimate of the heat loss in the animal shelter as compared to the ordinary artificially heated building is the moisture in the air, even though the excessive moisture is removed by the ventilation, the inside surface of the walls must be kept above the dewpoint of the air. The ordinary dry building does not have this factor to contend with and the insulation of the walls is merely a matter of economy of heating. However, in the barn, although the stock might be arranged so that the temperature of the barn room would be kept up, if the heat loss through the walls were not reduced sufficiently, the inside surface of the walls would be wet, and in cold weather would coat over with frost.

It is thus evident that the sanitation of the barn which is primarily dependent on the ventilation is inseparable from

*A portion of the report of the Subcommittee on Farm Building Ventilation presented at the fifteenth annual meeting of the American Society of Agricultural Engineers, Chicago, December, 1921.

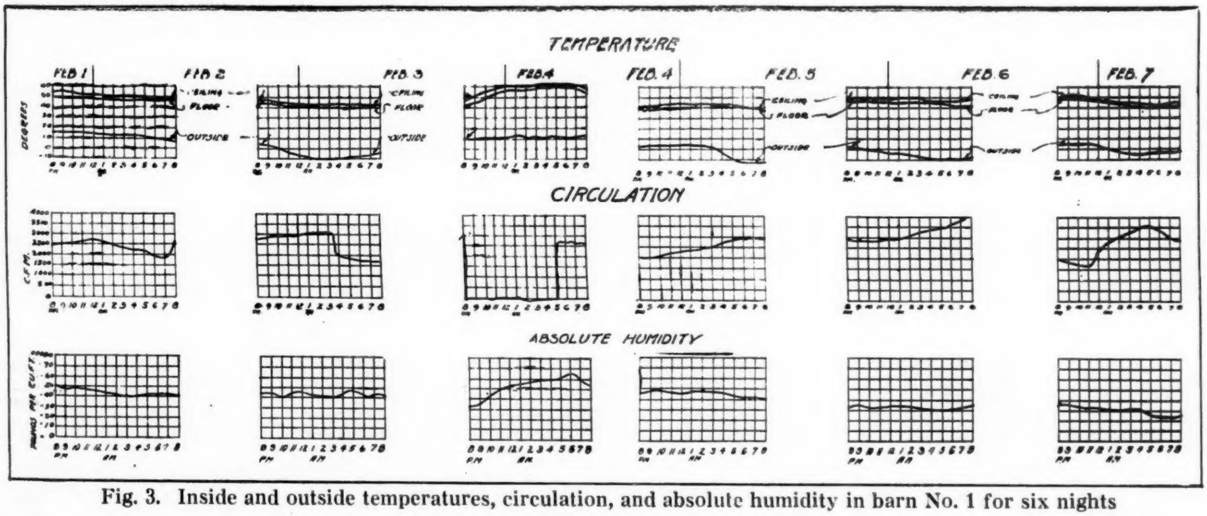


Fig. 3. Inside and outside temperatures, circulation, and absolute humidity in barn No. 1 for six nights

the study of building construction and the production of animal heat.

From three separate fields we have gathered information which, brought together, make up the analysis of the distribution of heat in the animal shelter. From the standpoint of the animal nutritionist we have arrived at the amount of heat produced by the animal. These experiments and measurements were made in the animal nutrition laboratories at the Pennsylvania State College. Animals were placed in a large calorimeter under conditions which differed considerably from the condition of the farm animal when in a barn.

The coefficients of heat loss for the various walls were obtained under laboratory conditions and have been proven practicable as applied to city buildings where artificial heat was used. These conditions again differ materially from the practical conditions of the farm barn.

From the experiments of physicists and from the great mass of work that has been done by heating and ventilating engineers, the measurement of air flow and the measurement of heat carried off in a cubic foot of air at a given temperature and moisture content has enabled us to make a definite estimate of the amount of heat, taken out of the room through the ventilating system.

The work of the subcommittee on farm building ventilation for the past year has been largely taken up with the application of this information to the actual conditions in the farm barn. This problem is a very unwieldy one, due to the many variable factors and to the difficulty of making exact measurements under farm conditions. However, we believe that whatever our results lack in mathematical precision will be made up in practicability. The method of our work has been to conduct what we have called a test, not of the ventilating system alone, nor of the walls of the barn, but a test of the barn as a means of obtaining sanitary conditions.

As yet it is impossible to present a summary of a large number of these analyses which would be well correlated and would absolutely prove the accuracy of the balance, especially in regard to the coefficients of heat loss. It is indeed doubtful if such a summary is desirable, because, if it were comprehensive enough to include the many variables it would be so unwieldy as to be uninteresting and intangible. Therefore, we are choosing instead to give examples of widely different conditions which, it is hoped, will be of real help in securing sanitary conditions in stables.

We will proceed to give in detail the problem of working out these balances in two barns, and in so doing will attempt to illustrate the influence of the factors, which we have discussed, upon the ventilation of animal shelter.

Barn No. 1 (Fig. 1, exterior; Fig. 2 floor plan) is a very well arranged barn from the standpoint of animal heat. There are only 476 cubic feet of air for each animal to heat so that this barn is very well heated. This should be borne in mind throughout the study of this test. This barn contained twenty-six purebred Guernsey milk cows, averaging 800 pounds each; twenty-two heifers, averaging 650 pounds; one bull weighing 1600 pounds; seven small calves, and one yearling. The estimated heat production is:

$$
\begin{aligned}
2200 \times 26 &= 57{,}200\\
2000 \times 22 &= 44{,}000\\
1 \times 3100 &= 3{,}100\\
1000 \times 7 &= 7{,}000\\
1 \times 1800 &= 1{,}800\\
\hline
\text{Total} \ldots\ldots & 113{,}100 \text{ B.t.u. per hour.}
\end{aligned}
$$

HEAT LOSS: Walls—860 (square feet exposed to outside air) $\times$ .48 = 461
Windows—111.5 (square feet) $\times$ 1.10 = 123
Doors—80 (square feet) $\times$ .55 = 44
Total heat loss = 628 B.t.u. per degree difference in temperature.

Then the estimated temperature difference, allowing for 59 cubic feet per minute per cow ventilation, is:

$$\frac{113{,}100}{628 + \dfrac{50 \times 60 \times 59}{55}} = 29.4 \text{ degrees}$$

There is a wide range in the amount of temperature difference that can be expected in barns. The only way that the temperature difference could be made greater is either to insulate the walls more carefully or to house more animals or

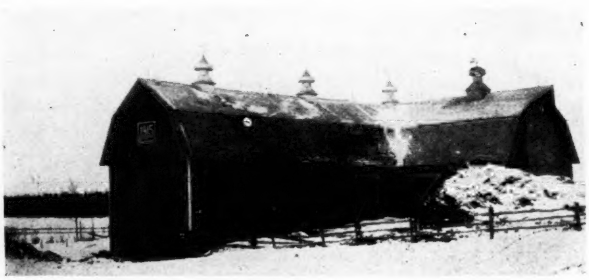


Fig. 1. Exterior of barn No. 1 as mentioned in text

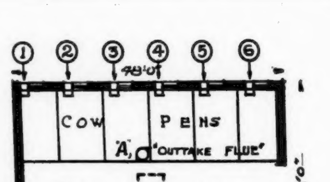


Fig. 4. Floor plan of barn No. 2 which contained 2½ times as much space for each animal to heat as barn No. 1

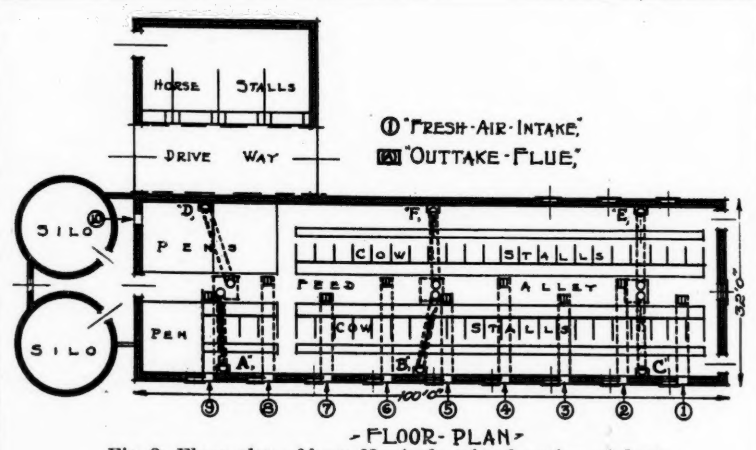


Fig. 2. Floor plan of barn No. 1, showing location of ducts

larger animals so that more animal heat is made within the barn room.

The heat loss through the ceiling and also the floor was disregarded because the ceiling was covered with a large amount of hay and the heat loss must have been very small and the floor, being concrete, directly on the earth and far below the surface of the ground could not have caused a great heat loss.

Fig. 3 shows the actual record of the temperature, circulation and absolute humidity in this barn. This is for the night period only, of six consecutive days. It will be noticed that the temperature difference varied from less than 30 degrees up to 50 degrees. This makes it evident that the temperature difference that will occur at any time is subject to many variations, but comparison of this test with the other tests shows that the analysis of the heat loss is a valuable index to what may be expected in actual conditions.

The test on the night of February 4 shows the actual condition which occurred when the ventilating system was closed off. It will be noticed that the temperature rose some 16 degrees and that the absolute humidity rose to double its value before the system was closed so that the room was excessively hot and very uncomfortable due to the presence of a great amount of moisture.

The purpose of this chart is to show that the actual temperature difference agreed with the estimated temperature difference substantially, and also to show that the conditions of the air in the barn was absolutely under the control of the ventilating system.

It is worthy of note that the circulation was continuous and of ample capacity to remove the excessive moisture when the system was left open and that the temperature was under the control of the ventilating system.

It is also interesting to know that on the night of February 4 when the outside temperature went to about 15 degrees below zero that the inside temperature remained practically constant, although the circulation increased with the falling temperature, and that the humidity was kept at approximately the same value as before.

The direct contrast to this barn is barn No. 2, shown in floor plan by Fig. 4. This barn was 36 by 48 feet and provided box pens for twelve test cows. It is in contrast to barn No. 1 in that the space for each cow to heat is 1230 cubic feet or two-and-one-half times as much as barn No. 1.

The difference in the condition of these two barns can be traced to this factor.

It was estimated that the twelve cows in this barn could produce 24,533 B.t.u. per hour. The heat loss through the walls was estimated at $1205 \times .26$, or 313 B.t.u. per hour per degree difference in temperature. For the windows the heat loss was estimated at 160×1.10, or 176 B.t.u. per degree difference in temperature and hour. Through the doors it was estimated to be $120 \times .42$, or 50 B.t.u. per hour. The total loss was 539 B.t.u. per hour per degree difference in temperature.

The estimated temperature difference was:

$$\frac{24{,}533}{539 + \dfrac{12 \times 59 \times 60}{55}} = 18.7 \text{ degrees.}$$

Comparing this estimated temperature difference of 18.7 degrees to the actual conditions, we find that it agrees very closely.

The difference in these two barns was not in the ventilating system because the system was approximately as well designed for one barn as for the other. The difference was in the ability to keep barn No. 1 warm and the lack of this ability in barn No. 2. Barn No. 2 was of more expensive construction because of the great amount of space for each animal, yet the sanitary conditions in this barn were not equal to those in barn No. 1. The owner of this barn was dissatisfied because it could not be kept warm during cold weather. Although this barn was warm enough during this test, during severe weather it was entirely too cold and the reason for this shows up in this test.

The tests of these two barns show that there is a need of designing the barn so that it will house enough animals to keep it warm and building the wall so that there will not be excessive heat loss through it.

In the arrangement of the floor plan of a barn it is well to remember that the lowest convenient height is about eight feet and that with this height a floor area of 75 square feet for each animal is allowable to come within the limit of 600 cubic feet per animal. When this is exceeded as in the illustration of barn No. 2, the building cannot be expected to be warm.

WARM CONSTRUCTION PREVENTS CONDENSING OF MOISTURE

Condensation can be prevented by keeping the absolute humidity low and by good insulation. The continuous production of moisture by the animals requires a continuous circulation of air to remove the moisture. The greater the difference in the absolute humidity of the inside air and the outside air, the less circulation is required to prevent the accumulation of moisture. In other words, the greater the circulation, the more nearly the absolute humidity can be maintained at the dry condition of the outside air.

In barn No. 1 the 50 head of stock probably produced about 30 pounds of moisture per hour. The circulation of 177,100 cubic feet per hour, about the average of the test, would remove this amount of moisture at a difference of $30 \div 177{,}000$, or 1.00017 pounds per cubic foot.

Actually, the absolute humidity inside of the barn was maintained at from 0.0003 to 0.0005 pounds per cubic foot. The maximum moisture content of air at zero degrees, about the temperature of the outside air at the time of the test, is 0.00008 pounds per cubic foot, so the actual difference between the humidity of the inside air and the outside air was not less than 0.00022 pounds per cubic foot during zero weather.

It is thus seen that the moisture content of the stable air can be reduced by increasing the amount of circulating air. The limit to which the amount of circulating air can be increased is limited by the loss of animal heat through the walls.

Because the absolute humidity of the air inside of the building must always be greater than that of the air outside, the walls must be well insulated so that the inside surface of the walls is not much colder than the air inside of the barn. If it is above the dewpoint of the inside air, no moisture will condense.

APPLICATION OF HEAT LOSS COEFFICIENTS

On the strength of the information collected and experience in studying the ventilation of farm buildings and the relation of the construction to sanitation, we do not hesitate to recommend as a portion of our report the tables of heat loss coefficients, which are quoted from the experiments of several authorities,[1] and which have a practical application to the obtaining of sanitary conditions in stables to the A.S.A.E. farm structures committee, as data upon which to base the construction of the walls of farm buildings.

[1]Authorities from which heat loss diagrams are quoted:

"Heating and Ventilation," Allen and Walker.

"A Study of Heat Transmission of Building Materials," Bulletin No. 102, Engineering Experiment Station, University of Illinois.

"New Heat Transmission Tables," by Wm. R. Jones, *Heating and Ventilating Magazine*, October, November, and December, 1913, being a summary of twenty-six authorities.

Agricultural Engineering Development

A Review of the Activities and Recent Progress in the Field of Agricultural Engineering Investigation, Experimentation and Research

Edited by **R. W. Trullinger**
Mem. A.S.A.E. Specialist in Rural Engineering, Office of Experiment Stations, U. S. Department of Agriculture

SEWAGE AND SEWERAGE OF FARM HOMES, G. M. Warren. [U. S. Department of Agriculture, Farmers Bulletin 1227(1922), pp. 55, figs. 35.] The purposes of this bulletin as stated are to emphasize basic principles of sanitation and to give directions for constructing and operating what are considered to be simple, serviceable, and safe home sewerage works.

No essentially new principles are outlined, and the bulletin is obviously a summary and presentation for practical use of well known sanitary engineering principles, with perhaps some recent improvements in equipment and apparatus of an apparently purely mechanical nature.

Much detailed and practical information in regard to specific apparatus, such as sanitary privies, septic tanks, and disposal systems, is presented, which is evidently the result of practical experience and observation of existing apparatus.

The intention seems to be to make the best practical use of present available knowledge. This is brought out by the very appropriate preliminary statement that "what is the best method and what the best outfit are questions not to be answered offhand from afar. A treatment that is a success in one location may be a failure in another. In every instance decision should be based upon field data and full knowledge of the local needs and conditions. An installation planned from assumed conditions may work harm."

CHILTON TRACTOR INDEX [Chilton Tractor Index, Philadelphia, 5(1922) No. 1, pp. 344.] This number of this index contains the usual data and information regarding tractors, tractor parts, tractor manufacturers, and related matters.

HISTORY OF WOOD PIPE AND SOME DATA ON ITS USE, E. J. Bartels [American Wood Preservers Association Proceedings, 17(1921), pp. 369-381, figs. 3.] The history of wood pipe for the conveyance of water is briefly reviewed and data on its use for the conveyance of water for water supply and for irrigation are presented and discussed.
Comments by B. Dibble are included.

RESULTS OF SOME TESTS OF THE EFFECT OF ZINC CHLORID ON THE STRENGTH OF WOOD, T. R. C. Wilson and E. Bateman. [American Wood Preservers Association Proceedings, 17(1921), pp. 80-88, figs. 11.] In a contribution from the forest service of the U. S. Department of Agriculture, studies on the effect of zinc chlorid on the strength of Douglas fir, long-leaf pine, and a small amount of spruce pine are reported. The test specimens were 2 by 2 inches by 4 feet. They were treated with dry zinc chlorid at rates of 0.25, 0.5, 0.75, and 1 pound per cubic foot. The tests were conducted four months, one year, and five years subsequent to treatment, and included static bending, impact, compression parallel to grain, compression perpendicular to grain, tension perpendicular to grain, and hardness tests.

It was found that for a short time subsequent to treatment there was a relation between concentration of preservative in the wood and strength properties, but later changes took place which modified this relation. The effect of the preservative very largely disappeard with some properties, such as modulus of elasticity and maximum crushing strength. In other cases, such as those test values which indicate resistance to shock, the effect of the lighter concentrations increased and there was a fairly definite indication of permanent and possibly increasing deteriorating effect.

THE MANUFACTURE OF ALCOHOL FROM MOLASSES, E. Humboldt. [Louisiana Planter, New Orleans, 68(1922), No. 13, pp. 206-208.] Some of the details of the process of the manufacture of alcohol from molasses are presented, together with brief information on production and by-products. It is stated that about one gallon of absolute alcohol can be made from 2.2 gallons of molasses containing 57.7 per cent of sugar.

TRACTORS IN NEW HAMPSHIRE, F. W. Taylor. [New Hampshire Agricultural College Extension Circular, Durham, 47(1922), pp. 4, fig. 1.] A brief report of a survey of the tractor situation in New Hampshire is presented which includes information obtained from fifty-eight tractor owners. It was found that the tendency in the state is toward the use of larger tractors. There are only a limited number of farms in the state with sufficient tillable land to justify the purchase of a tractor unless extended use is made of it for belt power. Eighty-one per cent of the tractor owners expressed themselves as being satisfied with their tractors. Most of these who are dissatisfied either had a tractor which was too small or one of a type not suited to their particular needs.

FARM BUILDINGS, W. A. Foster and D. G. Carter. [New York: John Wiley & Sons, Inc., 1922, pp. XV + 377, pl. 1, figs. 330.] This book deals with the location, planning, construction, and repair of farm buildings. Considerable of the material presented has been collected from state agricultural experiment stations. Chapters are included on the dairy barn; the horse barn; beef cattle and sheep barns; general purpose barns; barn equipment; essentials of barns; classification of barns; barn construction; barn framing; barn ventilation; hog houses; hog-house sanitation; poultry houses; grain-storage buildings; silos; implement and machine shelters; ice houses; minor buildings; homebuilt farm equipment; development of the farm house; planning the farm house; farm house construction; the tenant house; farm home equipment; farmstead planning; wood as a building material; cement and concrete; brick and hollow building tile; mechanics of farm buildings; building codes and fire prevention; contract and specifications; cost estimating; plan drawing; rafter framing and cutting; weights, measures, and formulas; and reference table for farm building design.

REPORT ON AGRICULTURAL IMPLEMENTS AND MACHINERY [London: (Great Britain) Standing Committee Investigating Prices, 1921, pp. 10.] This is a report of a special committee on the investigation of prices and costs of certain types of agricultural implements and machinery and profits obtained therefrom. No evidence of profiteering in the agricultural implement industry in Great Britain was found. The evidence indicates that the agricultural implement industry in Great Britain has been passing through a difficult and critical period which has resulted in a general decrease in business. This is attributed to a decrease in export trade due to war conditions, the rise in cost of raw materials, labor troubles, and costs, and the resulting high cost of the finished product. The opinion is expressed that the industry will not resume its normal conditions until the markets in central and eastern Europe are effectively reopened. It is concluded that general standardization is impracticable at present, but that it is greatly desirable that superfluous types be eliminated.

MOTOR ALCOHOL: ITS THEORY AND USE, J. P. Foster [Sugar Central and Planters News, Manilla, 2(1921), No. 11, pp. 521-526, figs. 3.] The results of considerable experience on the development of alcohol as a motor fuel are presented and discussed. It has been found that alcohol treated with ether which has been obtained from alcohol by dehydration makes the best motor fuel. The action of corrosive compounds formed by the combustion of such a mixture is considered to be a serious problem. The author's investigation of the subject has shown that the most suitable basic chemicals for neutralizing the corrosive acids in the mixture are the mines, either primary, secondary, or tertiary.

CONSTRUCTION AND USE OF HOMEMADE IMPLEMENTS FOR SUMMER TILLAGE, A. J. Ogaard and H. E. Murdock. [Montana Agricultural College Extension Circular, Bozeman, 47(1921) pp. 8, figs. 4.] This circular has been prepared to answer inquiries regarding the construction and use of homemade tillage implements designed for effective summer tillage, more especially under the dry farming conditions of Montana. These include the sled knife, gooseneck, rod, and double rod types of weeder. It has been found that the power required for these weeders varies greatly with the nature and condition of the soil and with the condition of the weeder if of the knife type. For average conditions it is stated that one horse will be able to pull about two feet of length of the rod type and three feet of the knife type.

THE SHRAWARDINE TRACTOR TRIALS, 1921, T. Close, B. J. Owen. and H. G. Richardson [Journal of the Ministry of Agriculture, London, 28(1922), No. 11, pp. 973-981.] A critical review is given of the results of the tractor trials conducted at Shrawardine, England, during September 1921, and conclusions drawn as to desirable lines of further research and development in tractors and tractor implements. Forty different tractors were entered for the trials and thirty-eight actually took part. Of the thirty-eight machines tested and demonstrated, there was not a single failure. It was clearly demonstrated that machines of different types can work steadily for a week without being held up by inherent mechanical defects.

A point made clear during these tests was that in the majority of cases only a fraction of the total power developed was available for useful work due to the lack of gripping power in the driving wheels. Frequently the drawbar horsepower did not represent more than one-third of the power which the engine was capable of developing. In nearly every case submitted to the drawbar tests the drawbar pull was limited by adhesion. It is considered evident that the problem of adhesion needs careful and prolonged study and that this is a field of research which should be included in the program for investigations in agricultural machinery.

It was found further that more energy was absorbed in displacing a greater depth of soil than a greater width, thus disproving the assumption that the resistance per square inch of furrow section varies directly as the depth of the furrow. One of the great disadvantages of the present-day wheel equipment for slip prevention was found to lie in the tedious methods which are employed for fixing or removing spuds. Most of the anti-slip devices were ineffective under certain conditions. The drawbar performance of the chain-track machines was very good as compared to wheel machines.

It is concluded that the real issue in this connection is to design a series of spuds or strakes which will meet variable conditions in such a way as to use, to the fullest extent, a minimum tractor weight together with the minimum of energy and disturbance of the soil, secure the maximum sensible area of contact, and still keep within the shear value of the soil.

The trials further indicated the wide variations existing in the rating of horsepower, and it is concluded that the need for a method of standardizing the power rating of tractors is vital. It was demonstrated further that although plows and other implements have been modified to take advantage of the capacity of the tractor type, no work of a fundamental character with a view, for example, to performing such work as plowing at greater speeds than that done by the horse plow has been done. It is concluded in this connection that investigation will have to be made on the lines of the effect of resistance in relation to such factors as speed, type of soil, and moisture content, together with laboratory studies of cohesion, plasticity, and relative motion of soil particles over the moldboard and the inversion of the furrow slice.

THE EFFECT OF THE ZINC CHLORID PROCESS OF PRESERVATION ON THE STRENGTH OF STRUCTURAL TIMBER, H. B. Luther. [American Wood Preservers Association Proceedings, 17(1921), pp. 89-114, figs. 17.] Experiments conducted at the Massachusetts Institute of Technology on the effect of preservative treatment with zinc chlorid on the strength of loblolly sapwood are reported. The specimens used were 2 by 2 by 30 inches, and the treatment was made by immersion in a cold solution. The specimens were stored in a group at room temperature and in ovens at temperatures of 100 and 150 degrees Fahrenheit.

No appreciable difference in strength was observed between treated and untreated timbers which had been stored at room temperature. A decrease of 3.5 per cent in compression strength parallel to the grain and of 17.6 per cent in cross bending strength was observed with specimens stored at 100 degrees. A decrease of 20.6 per cent in compression strength parallel to the grain and of 49 per cent in cross bending strength was observed for specimens stored at 150 degrees.

The conclusion is drawn that zinc chlorid, when used as a preservative, decreases the strength of timber subjected to relatively high temperatures and that this deteriorating effect is likely to be very marked under extreme conditions of heat and is continuous for several years.

ACTION OF ALKALI SALT ON PORTLAND CEMENT MORTARS, D. G. Miller. [Engineering and Contracting, Chicago, 57(1922), No. 15, pp. 359, 360, fig. 1.] Studies conducted under a cooperative agreement between the U. S. Department of Agriculture and the University of Minnesota on the influence of magnesium sulphate on Portland cement concrete are reported.

Test cylinders of concrete made of Standard Ottawa sand and of screened and pit-run Minnesota sand were immersed in solutions containing 1, 2, 4, and 8 per cent of magnesium sulphate. It was found that the concrete highest in quality, as indicated by strength and absorption, best withstood the deleterious action of magnesium sulphate.

A. S. A. E. and Related Activities

Nominating Committee Report

THE Nominating Committee of the American Society of Agricultural Engineers has submitted the following report on candidates for officers of the Society for 1923:

For President:

E. W. LEHMANN, professor of farm mechanics, University of Illinois.

G. B. GUNLOGSON, research engineer, J. I. Case Threshing Machine Company.

For First Vice-President:

I. D. WOOD, extension agricultural engineer, University of Nebraska.

A. H. GILBERT, chief engineer, tractor division, Rock Island Plow Company.

For Second Vice-President:

R. W. TRULLINGER, specialist in rural engineering, U. S. Department of Agriculture.

K. J. T. EKBLAW, agricultural engineer, Portland Cement Association.

For Treasurer: RAYMOND OLNEY

For Member of the Council:

WM. AITKENHEAD, professor of agricultural engineering, Purdue University.

J. C. WOOLEY, professor of agricultural engineering, University of Missouri.

E. R. WIGGINS, sales engineer, Holt Manufacturing Company.

Nominating Committee:

W. B. CLARKSON, chief of research and extension, King Ventilating Company.

M. A. R. KELLEY, barn architect, U. S. Department of Agriculture.

A. P. YERKES, editor, "Tractor Farming," International Harvester Company.

C. O. REID, research engineer, Samson Tractor Company.

E. M. MERVINE, associate professor of agricultural engineering, Iowa State College.

The above list of candidates will be submitted to secret membership ballot of the Society on or about September 20.

A.S.A.E. Land Clearing Activities

PROF. John Swenehart, chairman of A. S. A. E. land clearing committee, reports some interesting projects which his committee has under way. The following lines of investigation are being carried on and some valuable information and data is anticipated as the result of efforts in these directions:

1. The effect of fire in land clearing operations (Minnesota)
2. Brush plowing and other methods of handling brush (Minnesota—Wisconsin)
3. Stone removal (Minnesota)
4. Study of decay of stumps (Michigan)
5. Study of land clearing explosives (Wisconsin)
6. Study of mechanical stump pulling outfit for lake state condition (Wisconsin)
7. Decay of brush and use of land when large brush is plowed down (Wisconsin cooperative land clearing and agricultural bacteriology)
8. Study of miscellaneous land clearing devices for land clearing (Wisconsin, Minnesota and Michigan)

In addition to the foregoing a special effort is being made to create some activity in land clearing work in the South.

Appointments to A.E.C.

PRESIDENT A. J. R. Curtis has appointed S. H. McCrory head of the division of agricultural engineering in the U. S. Department of Agriculture as representative of the American Society of Agricultural Engineers on the American Engineering Council, the executive body of the Federated American Engineering Societies, of which the A. S. A. E. is a member. F. W. Ives, head of the department of agricultural engineering at Ohio State University has been appointed as alternate representative on the American Engineering Council. These two appointments are effective beginning January 1, 1923.

Reclamation Section Meeting in September

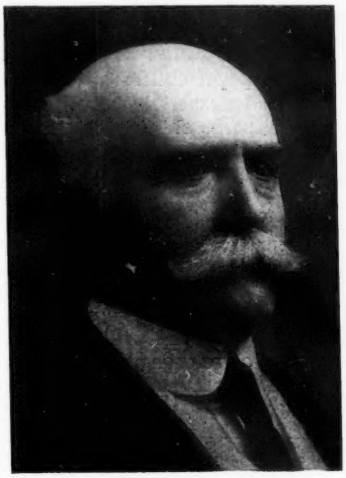
PLANS are under way for a professional meeting and dinner of the Reclamation Section of the American Society of Agricultural Engineers at Kansas City on September 26, during the convention of the National Drainage Congress. The principal address of this meeting will be delivered by Walter W. Weir, assistant professor of soil technology, University of California. S. H. McCrory, head of the U. S. D. A. division of agricultural engineering, will preside at the meeting.

American Construction Council Organized

THE American Construction Council was formally launched as a result of a two-day organization meeting held in Washington in June. The meeting was attended by about one hundred and seventy representatives of the various groups concerned with construction. Mr. Hoover opened the meeting with a characteristically pointed and illuminating address. Mr. Townley stated that the executive board of the Federated American Engineering Societies had voted an expression of cordiality and cooperation. The keynote was the great need for the formation of some agency that would have as its chief function the removal from the construction industry the many ills that it now possesses. The program committee submitted the following as the lines of activity to be undertaken by the Council. These recommendations were adopted by the conference: (1) The formation of a code of ethics acceptable to the whole industry and to the public; (2) gathering of adequate statistic from all sources; (3) reduction of the national shortage of building trade mechanics and the establishment of the necessary apprenticeship system; (4) cooperation in establishing uniform building codes throughout the country; (5) cooperation with railways in expediting the revision of existing freight rates on construction materials; (6) the establishing and strengthening of local organizations throughout the country to bring about the cooperation of all elements in conformity with the principles of the council; (7) the investigation of the evils of seasonal employment and migration of labor; (8) the encouragement of local building shows; (9) simplification and the elimination of waste; (10) education of the public as to the desirability of a better distribution of its construction and maintenance requirements; (11) promotion of health and safety for workmen and the reduction of loss of life; (12) the reduction of waste of construction materials from preventable fires; (13) the study of old buildings in order to establish superior methods of construction; (14) the education of the public as to the necessity and economy of properly maintaining structures.

About A.S.A.E. Members

JOSEPH DOTY OLIVER, elected an honorary member of the American Society of Agricultural Engineers in December 1921, is the only son of James Oliver, the inventor of the chilled plow. Mr. Oliver was born August 2, 1850, at Mishawaka, Indiana, and after receiving his education at Notre Dame and De Pauw universities, he entered his father's factory to learn the plow business.



JOSEPH DOTY OLIVER

The chilled moldboard, which outwears steel for plowing in gritty soil conditions, was the invention of James Oliver, but it was largely the efforts of his son, Joseph Doty Oliver, that popularized this plow and placed it where it stands today.

The placing of the plow furrow wheels at an angle to the furrow wall, the rolling landside and the sloping landside, all of which have to do with decreasing the draft of plows, are Oliver inventions. The combined rolling coulter and jointer is a recent invention that has contributed greatly to making better, more scientific plowing possible.

Mr. Oliver insists that his designers use every effort to simplify Oliver implements and improve their usefulness in the field.

For over fifty years Mr. Oliver has been identified with the Oliver Chilled Plow Works, and since the death of his father in 1908 has been its directing head. During his administration of the business, it has not only experienced a remarkable growth, but the institution's reputation for fair dealing and recognized quality of its product have reached an exceptionally high standard.

DAVID E. BALL is at present doing hydrographic work in connection with the operation and maintenance of the storage unit of the Yakima project. Just recently he started on a water supply survey of the Yakima River system, the object of which is to obtain information relative to the various diversions of water from the Yakima River and its tributaries. The data is obtained by covering the ground and by interview with the various diverters. This investigation is revealing may interesting things in regard to water rights and the use of water in the various districts. He reports that work on the Tieton Dam which, when completed, will be one of the largest earth-filled dams, is going ahead. About two more years will be necessary to complete it when 200,000 acre-feet of storage will be added. That amount of additional water available for irrigation will mean much to the Yakima Valley.

R. U. BLASINGAME, professor in charge of farm machinery at the Pennsylvania State College, is in charge of a campaign in his state to secure the cooperation of hardware and farm-equipment dealers in securing $100,000 to construct a dormitory unit for men as a part of a $2,000,000 campaign for welfare buildings at the state college. The potato growers of his state have subscribed two-thirds of the amount necessary to build a student hospital costing $150,000. The cornerstone of this building will be laid August 25 on Potato Field Day, at which time all classes of potato machinery will be exhibited. They have a record of a sale of one thousand potato sprayers in the last two and a half years as a result of their extension work with the potato people.

P. B. BROWN is employed as agricultural engineer in connection with tractor service by Robbins-Smith Company, local distributors of Ford Motor Company at Portland, Oregon. He has also been to some extent associated with C. S. BRISTOW, another A. S. A. E. member, in the development of a new tractor.

L. W. CHASE, president of the Chase-Tinsman Plow Company, and formerly head of the department of agricultural engineering at the University of Nebraska, reports that the new lister which his company placed on the market last year took so well that they were several hundred short. This year they have already received orders for about fifty per cent more than they manufactured last year. Prof. Chase is optimistic about the future of his business and states that the outlook for 1923 is very gratifying indeed; he says farmers are buying very little but what they can pay for, which is an excellent condition of affairs.

W. B. CLARKSON has been licensed under the state laws of Minnesota as a registered professional engineer. While there are a large number of men licensed as professional engineers in various states specializing in mechanical draft ventilation, so far as known Mr. Clarkson is the only licensed professional engineer specializing in natural draft ventilation for all classes of buildings closely related to farming operations.

G. L. COSTIGAN, who is in the drainage contract business, in which machines are employed principally in construction work, has just completed two Sac County (Iowa) drainage contracts, one for $26,000 and the other $40,000. He was awarded the contract for a $45,000 drain in Kossuth County in April and is now at work on that project. He is located at Algona, Iowa.

A. J. R. CURTIS (President of the Society) and K. J. T. EKBLAW, of the Portland Cement Association, are making an intensive study of the improvement of farm and rural residences. The possibility of procuring fire protection for the country home, and the frequency with which fires have occurred in farm homes, has led them to believe that moderately priced houses of good architectural appearance would be welcome. The research in this direction has developed some very interesting information concerning the design of cisterns, septic tanks, and other adjuncts to the farm house. They feel at the present time they have something to offer and are accomplishing worthwhile results.

R. H. DENMAN, until recently connected with the department of rural engineering of the Massachusetts Agricultural College has accepted a position in charge of farm mechanics work at Essex Agricultural School, Hawthorne, Massachusetts.

E. R. GROSS, until recently head of the department of agricultural engineering of the Mississippi A. & M. College, has accepted a position as head of the department of rural engineering at Rutgers College and the State University of New Jersey.

FRANK P. HANSON, of the Portland Cement Association, while spending his vacation in Iowa, recently attached himself during his respite to various Iowa concrete contractors and had a riotous time tending the mixer and wheeling the "goo."

Evan A. Hardy has been spending the summer at the Iowa State College doing some advanced work in agricultural engineering to apply upon his master's degree in agricultural engineering from that institution. He will return to take up his work again in the agricultural engineering department of the University of Saskatchewan.

Frederick W. Ives, professor in charge of agricultural engineering at the Ohio State University, recently spent a week visiting the departments of agricultural engineering at the Iowa State College and the University of Nebraska. Prof. Ives has charge of the new agricultural buildings under construction at the University of Ohio.

M. S. Klinck has resigned as head of the department of rural engineering at Rutgers College, New Brunswick, New Jersey, and will take up work to complete the mechanical engineering course at Ohio State University. At the same time he will assist in instructional work in the department of agricultural engineering under Prof. F. W. Ives. He will be succeeded at Rutgers College by Prof. E. R. Gross.

E. R. Wiggins, as announced in the July number of the Journal as having become associated with Holt Manufacturing Company, Peoria, Illinois, is to do special work as a sales engineer. Mr. Wiggins goes to the Holt organization following a long experience in the tractor field, extending from the days of the first Winnipeg Motor Contests. During this period he was connected with the J. I. Case Threshing Machine Company, Aultman & Taylor Machinery Company, and Deere & Company in their various engineering and experimental departments on tractor development. During 1912, while connected with the University of Nebraska, he conducted a complete survey of Nebraska with reference to the use of tractors.

New Members of the Society

Members

D. W. Griffin, agricultural engineer, Gwalior, Gwalior State, India.

Thomas Forrest McGilvray, 503-4 Court House, Duluth, Minnesota.

Transfer of Grade

James Franklin Harkey, RFD No. 1, Charlotte, North Carolina.
(From Student Branch to Junior Member)

John Frank McBane, RFD No. 1, Saxaphau, North Carolina.
(From Student Branch to Junior Member)

Charles Phillips Robinson, Jr., Morven, North Carolina.
(From Student Branch to Junior Member)

Walter F. Weaver, Medina, Ohio.
(From Student Branch to Junior Member)

Applicants for Membership

The following is a list of applicants for membership received since the publication of the July issue of Agricultural Engineering. Members of the Society are urged to send pertinent information relative to the applicants for the consideration of the Council prior to their election.

Earle Horace Daniel, 1101 West Pleasant Street, Springfield, Ohio.

For Transfer of Membership Grade

Willis W. Brittain, Horse Shoe, North Carolina.

Edward Fabian Byerley, 3443 Dudley Street, Lincoln, Nebraska.

Burr S. Eichelman, Downers Grove, Illinois.

Guy Garrett Glunt, RFD No. 6, Union City, Indiana.

Eugene George McKibben, division of agricultural engineering, University Farm, Davis, California.

Frank U. Naughton, Jr., c/o Emerson-Brantingham Co., Rockford, Illinois.

John Caldwell Ralston, Jr., Caledonia, Illinois.

Benjamin G. Van Zee, Pella, Iowa.

James A. Waller, Jr., Virginia Polytechnic Institute, Blacksburg, Virginia.

W. Leland Zink, division of agricultural engineering, University of California, Davis, California.

Dockage Removal Paper Popular

The paper entitled "Removing Dockage from Wheat at the Thresher" by Robert H. Black, an A. S. A. E. member in charge of grain cleaning investigations for the U. S. Department of Agriculture, presented at the last annual meeting of the Society and published in the January, 1922, number of AGRICULTURAL ENGINEERING, has appeared in whole or part in more than fifty publications since that time. Not only is the idea of removing dockage from grain at the thresher economically correct, but the publicity that has been given to it indicates also that it is popular. As a matter of fact, there are few problems that are of more importance than this one of dockage, and it is one to which those who are engaged in carrying the gospel of better agriculture to farming cannot give too much publicity and encouragement. It is one to which the American Society of Agricultural Engineers is glad to give its whole hearted support. The field tests and investigations which are being made this year will be watched with a great deal of interest. They will be given to members of this Society later through Mr. Black.

EMPLOYMENT SERVICE

This service, conducted by the American Society of Agricultural Engineers, appears regularly in each issue of Agricultural Engineering. Members of the Society in good standing will be listed in the published notices of the "Men Available" section. Non-members, as well as members, are privileged to use the "Positions Available" section. Copy for notices should be in the Secretary's hands by the 20th of the month preceding date of issue. The form of notice should be such that the initial words indicate the classification. No charge will be made for this service.

The Secretary receives at frequent intervals bulletins from the Engineering Societies' Service Bureau, 29 West 39th Street, New York City, listing the "positions open" as reported by member societies. Copies of these bulletins are sent to the "men available" listed below, as soon as received.

Men Available

AGRICULTURAL ENGINEER wants position as experimental agricultural engineer or with some agricultural publication. Graduate, 1918, agricultural college of the University of Illinois. Was editor of the Illinois agricultural students publication in his senior year. For two years employed by an explosives manufacturer as agricultural sales and service man for the State of Wisconsin. At present associated with the land clearing department of the University of Wisconsin. Age 25, married, American. MA-101

MECHANICAL AND ELECTRICAL ENGINEER, graduate of Cornell University and Armour Institute, with nineteen years of practical experience in designing, manufacturing, and marketing gasoline engines, automobiles, motor trucks and tractors, having specialized particularly on internal-combustion motors and their application, prefers mechanical work cooperating with the different manufacturing and sales departments along the lines of sales engineering, or other work into which his qualifications would fit. MA-104

AGRICULTURAL ENGINEER wants position in southwest. Graduate of University of Illinois 1915, five years practical experience on Illinois farm with power equipment, two years in charge of the agricultural engineering department New Mexico College of Agriculture; considerable garage experience and service experience on unit power and light plants. Also one summer in Philadelphia battery service station. MA-106

AGRICULTURAL ENGINEER, graduate in mechanical engineering at Michigan Agricultural College, desires position teaching all kinds of farm machinery or automotive work, or with some farm-equipment manufacturer. Will be available April 1, 1922. Has served one year as instructor in tractors and trucks, and one year conducting service schools for a leading tractor manufacturer. Can furnish best of references. MA-110

AGRICULTURAL ENGINEER, graduate of Iowa State College 1920, with several years of practical experience farming with machinery and one year's teaching experience in high school, wants employment on a large farm or in college teaching of power farming. Twenty-five years of age. Married. MA-111

AGRICULTURAL ENGINEER wants position as demonstrator of farm machinery or building equipment, or executive position on agricultural engineering project; or conducting field tests. Accustomed to handling men and dealing with farmers and farm problems. Prefers northern location. MA-113.

CIVIL ENGINEER, graduate of University of California, with major in irrigation, formerly assistant engineer of Idaho Irrigation Company, in connection with canal enlargement, betterment, etc., and more recently associate professor of agricultural engineering at the University of Idaho in charge of irrigation, drainage, farm surveying, etc., desires position in civil engineering, in land reclamation, or teaching. Age 31. Married. Two children. MA-114.